

WHAT IS CLAIMED IS:

1. A device for the propagation of tissue comprising a bioartificial composite comprised of a substrate having at least one surface capable of the reception and growth promoting retention of a cellular preparation, and a first layer of adherent cells disposed on said surface, said first layer prepared from said cellular preparation, the cells comprising said first layer having cytoskeletal elements aligned uniformly, wherein said bioartificial composite acts as a template to accept a second layer of cells upon said first layer, said second layer comprising an organized layer oriented in the direction of said first layer, wherein said substrate has at least one surface defined by a critical surface curvature and/or topography.
2. The device of Claim 1 wherein said substrate has at least one cell accepting surface defined by an oriented surface roughness of at least 200 nm root mean squared.
3. The device of Claim 1 wherein said substrate has at least one cell accepting surface defined by a surface curvature of equal or greater than .016 microns<sup>-1</sup>.
4. The device of Claim 1 wherein said substrate defines a repeating surface structure.
5. The device of Claim 1 wherein said bioartificial composite possesses an over all non-planar shape.
6. The device of Claim 1 wherein said substrate is coated with a biocompatible, growth promoting preparation, which preparation minimizes non-specific protein binding and optimizes attachment of said cells.
7. The device of Claim 6 wherein said preparation is selected from the group consisting of surfactants, cell adhesion molecules, polycations, cell growth factors, and mixtures thereof.

8. A device for the preparation of implantable tissue comprising a bioartificial composite comprised of a substrate having at least one surface capable of the reception and growth promoting retention of a cellular preparation, and a first layer of adherent cells disposed on said surface, said first layer prepared from said cellular preparation, the cells comprising said first layer having cytoskeletal elements aligned uniformly, wherein said bioartificial composite acts as a template to accept a second layer of cells upon said first layer, said second layer comprising an organized layer oriented in the direction of said first layer, wherein said substrate has at least one surface defined by a critical surface curvature and/or topography.

9. The device of Claim 8 wherein said substrate has at least one cell accepting surface defined by an oriented surface roughness of at least 200 nm root mean squared.

10. The device of Claim 8 wherein said substrate has at least one cell accepting surface defined by a surface curvature of equal or greater than .016 microns<sup>-1</sup>.

11. The device of Claim 8 wherein said substrate defines a repeating surface structure.

12. The device of Claim 8 wherein said bioartificial composite possesses an over all planar shape.

13. The device of Claim 8 wherein said bioartificial composite possesses an over all non-planar shape.

14. The device of Claim 8 wherein said substrate is coated with a biocompatible, growth promoting preparation, which preparation minimizes non-specific protein binding and optimizes attachment of said cells.

15. The device of Claim 14 wherein said preparation is selected from the group consisting of surfactants, cell adhesion molecules, polycations, cell growth factors, and mixtures thereof.

16. The device of Claim 8 wherein said bioartificial composite is defined by at least one filamentous substrate.

17. The device of Claim 8 wherein said bioartificial composite is defined by at least one cylindrical substrate.

18. The device of Claim 17 wherein said substrate has a diameter of less than 300  $\mu\text{m}$ .

19. The device of Claim 8 wherein said substrate of said bioartificial composite further defines an axially aligned surface topography, and is coated with cell attachment molecules; and a layer of cells attached to said molecules, which cells are adapted to undergo morphological rearrangement to align with the long axis of said substrate; and at least one second cell layer of different cells that attached to the free upper surface of said first layer, which is also adapted to undergo the same said morphological rearrangement.

20. The device of Claim 19 wherein the morphological rearrangement of said first layer of cells which comprises the bioartificial composite is promoted and effected by the imposition of suitable force on said first layer and/or said substrate.

21. A method for the preparation of the device of either of Claims 1 or 8, which method comprises:

- preparing a suitable biomaterial as a three dimensional structure selected from sheets, strips, strands of indefinite length and fibers;
- treating at least one outer surface of the biomaterial prepared in Step a. to form thereon at least one said surface for the reception of said first layer of cells;
- recovering said treated biomaterial defining the said at least one surface of Step b.;

wherein said biomaterial film of Step c. is adapted to serve as substrate for said device.

22. A method for the preparation of a bioartificial composite useful for repair of tissues or organs in a host, said method comprising:

a. preparing a substrate defining a surface having the morphological characteristics of the desired tissue;

b. applying to the surface of said substrate a cellular preparation, said cellular preparation comprising a quantity of cells capable of growth and aggregation to form a component of said tissue; and

c. implanting the bioartificial composite of Step b. at the location of desired repair,

whereby the growth of said tissue takes place in the host.

23. The method of Claim 22 wherein said cellular preparation of Step b. is of a different cell type from that of said tissue.

24. The method of Claim 22 wherein said cellular preparation of Step b. is genetically modified to deliver a therapeutic compound useful in the treatment of disease or the promotion of tissue repair.

25. A method for the repair of damaged tissues or organs in a mammal comprising preparing a biological composite in accordance with the method of Claim 22.

26. A method for the preparation of tissue useful for repair of tissues or organs in a host, said method comprising:

a. preparing a substrate defining a surface having the morphological characteristics of the desired tissue;

b. applying to the surface of Step a. cellular preparation, said cellular preparation comprising a quantity of cells capable of growth and aggregation to form said tissue;

c. incubating the substrate of Step b. under conditions promoting the growth of said tissue thereon; and

d. recovering the tissue prepared in Step c.

27. A method for the preparation of tissue useful for testing, development and discovery, said method comprising:

a. preparing a substrate defining a surface having the following characteristics:

- i. at least one cell accepting surface defined by an oriented surface roughness of at least 200 nm root mean squared;
- ii. at least one cell accepting surface defined by a surface curvature of equal or greater than .016 microns<sup>-1</sup>; and
- iii. said substrate defines a repeating surface structure;

b. applying to the surface of Step a. a cellular preparation, said cellular preparation comprising a quantity of cells capable of growth and aggregation to form a layer of cells;

c. incubating the bioartificial product of Step b. with a different type of cell to effect growth of said tissue thereon; and

d. recovering the tissue prepared in Step c.;

wherein said tissue may be used as a benchtop testing system or tissue surrogate.

28. A method for the preparation of tissue useful for repair of tissues or organs in a host, said method comprising:

a. preparing a substrate defining a surface having the following characteristics:

- i. at least one cell accepting surface defined by an oriented surface roughness of at least 200 nm root mean squared;
- ii. at least one cell accepting surface defined by a surface curvature of equal or greater than .016 microns<sup>-1</sup>; and
- iii. said substrate defines a repeating surface structure;

b. applying to the surface of Step a. a cellular preparation, said cellular preparation comprising a quantity of cells capable of growth and aggregation to a layer of cells;

c. incubating the bioartificial product of Step b. with a different type of cell to affect growth of said tissue thereon; and

d. recovering the tissue prepared in Step c.;

wherein said tissue may be used for therapeutic purposes.

29. The method of Claim 28 wherein said cellular preparation of Step b. is genetically modified to deliver a therapeutic compound useful in the treatment of disease or the promotion of tissue repair.

30. A method for the preparation of tissue useful for repair of tissues or organs in a host, said method comprising:

- a. preparing said tissue as in Claim 29; and
- b. implanting said tissue at the desired site for tissue or organ repair.

31. The device of Claim 1 wherein said cellular preparation comprises cells taken from said host.

32. The device of Claim 8 wherein said cellular preparation comprises cells from the tissues adjacent to the site of the implant of the device, that grow along said platform surface.

33. The device of either of Claims 1 or 8 wherein said substrate is bioresorbable.

34. The device of either of Claims 1 or 8 wherein said substrate is flexible.

35. The device of either of Claims 1 or 8 wherein said cells comprise cells of the nervous system.

36. The device of Claim 35 wherein said cells are derived from the CNS.

37. The device of Claim 35 wherein said cells are selected from neurons, glial cells, astrocytes, microglial cells, dorsal root ganglion (DRG) cells.